Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/432
JAPAN
February 1964
Submitted in:
ENGLISH and FRENCH

Confidential until official release during Conference

Abstract

DEVELOPMENT OF BONDING METHODS FOR GRAPHITE MATERIALS

Yoshio Ando, Tokyo University
Tadato Fujimura, Japan Atomic Energy Research Institute
Mitsuo Nomaguchi, Tokai Electrode Mfg. Co.
Yoshihiko Inoue, Nippon Carbon Co.

Graphite possesses good nuclear properties, and is resistant to heat and corrosion, which properties have caused this material of recent to be rapidly developed for nuclear uses. Graphite, however, is very difficult to fabricate and, particularly, bonding without affecting the above properties has presented many problems.

Since 1959 Tokyo University, Japan Atomic Energy Research Institute, Tokai Electrode Mfg. Co. and Nippon Carbon Co. have co-operated in a project for developing brazing materials and methods, and a number of notable results have been obtained.

1. Brazing materials

The authors have found a new brazing material of Ni-Fe-Ti alloy. The brazing temperatures possible with this material are 1300-1600°C, so that the brazed graphite joints are serviceable at temperatures of 700-1000°C. Tested for long periods at elevated temperature, the bond showed no indication of carbide formation to embrittle the bond.

Another form of the same brazing material developed by the authors is a paste obtained by mixing the metals in powdered state, using an organic compound such as styrene for binder. The advantage of this paste is the possibility of obtaining different kinds of composition to suit particular purposes, thus providing a very versatile brazing material. The binder decomposes by heat during brazing, but leaves little residual carbon, and being free of oxygen in its molecular structure it does not affect the bond.

2. Brazing methods

The authors have further contributed to the development of vacuum brazing, inert-gas-shielded arc brazing (Tig brazing), and resistance brazing. Other new techniques developed include reinforcement with metallic deposit beads and double-pass Tig brazing.

3. Bonding of metallic terminals on SiC electric heaters

SiC is a good heater material for in-pile experiments since it can provide high temperatures and high power density, at the same time permitting the use of a high voltage and low current system.

SiC heater terminals have in the past been fixed mechanically, which limited the temperature at terminal to 200°C.

The authors have found a new process by which titanium terminals can be bonded to SiC heaters with graphite as interspacer.

The terminals fixed by this process are capable of withstanding 1000°C.